PERIODIC NOISE REMOVAL IN IMAGES

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Abstract

The reduction of noise in images is a crucial issue and an inevitable pre-processing step in image analysis. Many diverse noise sources, which disrupt source images, exist in nature and through man-made devices. Periodic noise is one such disruption that has a periodic pattern in the spatial domain, causing hills in the image spectrum. It can be reduced significantly via frequency domain filtering. Here, I use a notch reject filter with an appropriate radius to completely enclose the noise spikes in the Fourier domain. The notch filter rejects frequencies in predefined neighborhoods around a center frequency. The number of notch filters is arbitrary. The shape of the notch areas can also be arbitrary. I use three circular shape notch reject filters. Power spectrum densify of an image is used for the noise spikes visual detection. In this study, I designed an algorithm for Period Noise Removal of both single grid noise or 2D grid noises.

Key words: Noisy Grid, FFT, Power Spectral Density, SynthesizeFilter, Restoration, IFFT.

Filter Synthesis Function

$$SynthesizeFilter(h, w, pos) \quad (1)$$

$$1.Selectheight, widthfromInput \quad (2)$$

$$2.Lettheinputallones.Selectpositions: \quad (3)$$

```
xmin = pos(1);        ymin = pos(2);
w1 = pos(3);          h1 = pos(4);
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$$3.update \quad h, w, pos \quad now-- \quad (4)$$

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OutImg(ymin:ymin+h1, xmin:xmin+w1) = 0;
ym2 = h - pos(2) - h1+3;
OutImg(ym2:ym2+h1, xmin:xmin+w1) = 0;
xm2 = w - pos(1) - w1+3;
OutImg(ymin:ymin+h1, xm2:xm2+w1) = 0;
OutImg(ym2:ym2+h1, xm2:xm2+w1) = 0;
```

Conclusion

In this task work, Experimental Results with this model on the representative landmark Lena image demonstrate the efficient removal of noise on the Lena image. Therefore, it is promising to observe performance of this algorithm on Regular noise grids on images with images variant in brightness, color, deformed, scaled and poor edges etc and recognized as the state-of-art algorithms.

References

[1] https://dergipark.org.tr/tr/download/article-file/433724

[2] https://en.wikipedia.org/wiki/Noise$_r eduction$

Algorithm Design For Noise Removal in 1D and 2D grids

1. I made use of inclined grid noise on Lena image first, then perform Fast-Fourier-Transform(FFT).
2. Power Spectral Density Plot is constructed depending on the previous FFT output.
3. I proposed a Synthetic Filter which is adopted to PSD with desired selection of positions in plot.
4. Thus it is called the Desired Restoration Mask. Since, objective behind is to apply to three spotted positions of PSD plot in-order to have maximum image amplitude in Reconstructed image.
5. Optimized Statistical calculations is made on minimum level of intensities and Inverse Discrete Fourier transform(IFFT) to observe the Recovered Image.
6. Mean Square Error is estimated to regulate the error between the input and the original image. Therefore this increases the SNR ratio.

Results Analysis - 1

Stage 1: illustrates the Lena Image in gray scale.

Figure 1: Original Input image

Stage 2: illustrates the Lena Image with 1D grids applied on Lena image.

Figure 2: 1D Grid Applied as Noise to Lena image

Stage 3: illustrates the Lena image PSD + FFT enables to select three points on the spectrum

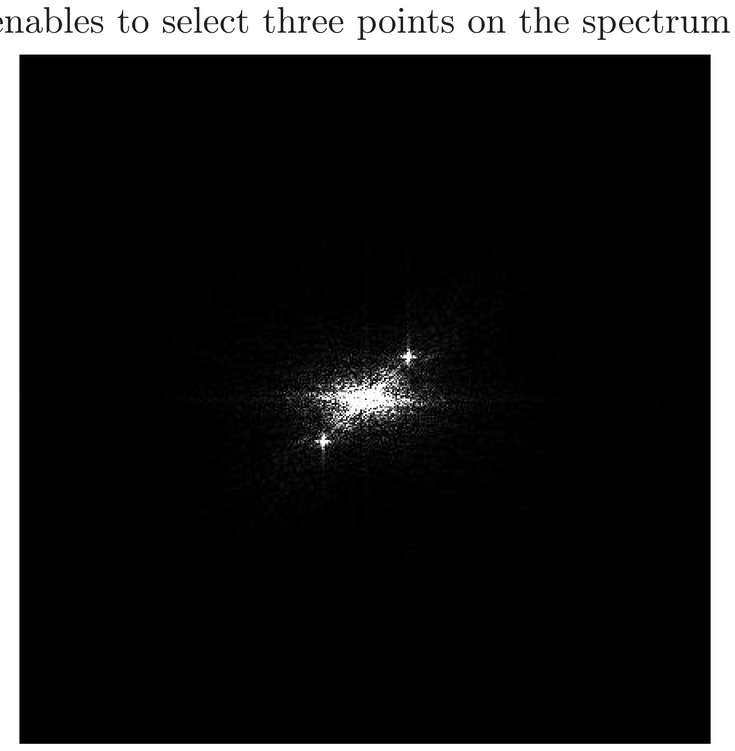

Figure 3: Computed Power Spectral Density

Results Analysis - 2

Stage 4 illustrates the Synthesized Filter Output (Here you can observe three positions you selected on the spectrum with the filtered output)

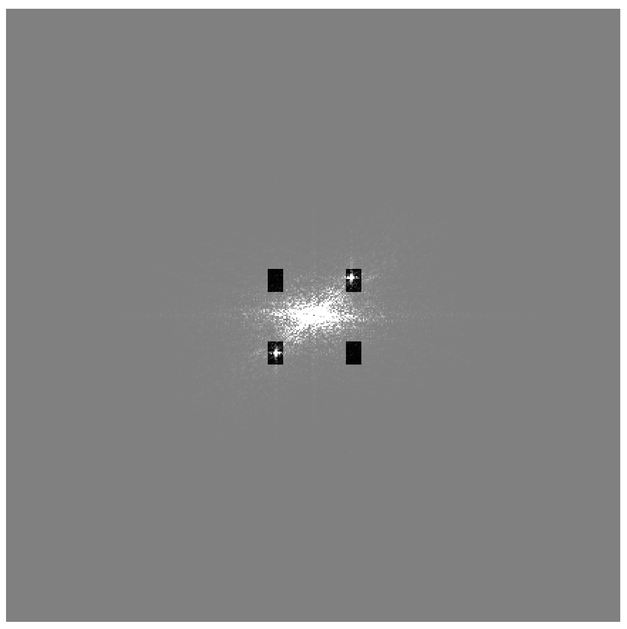

Figure 4: Filtered Output that means Filter applied then after Inverse Fast Fourier Transform (IFFT). Now we are ready to restore the image

Stage 5: illustrates the statistical computations and gives the restored image based on the selected points on the PSD spectrum.

Figure 5: Restored Lena Image free from inlined-Grid Noise

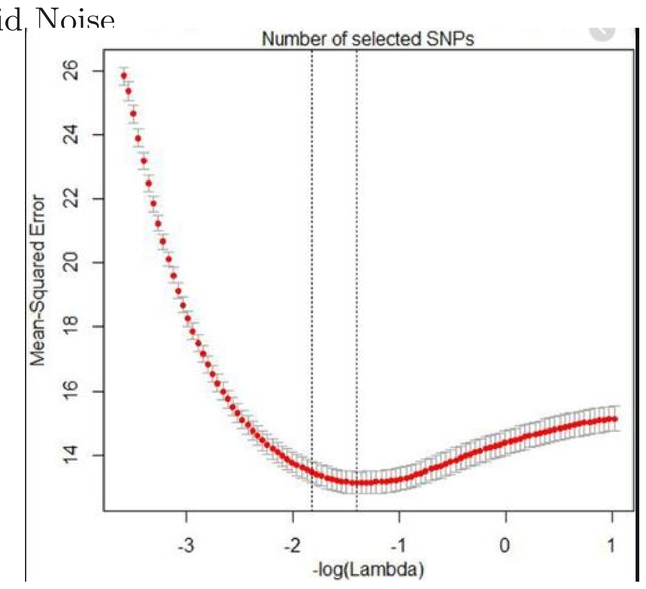

Figure 6: Mean-Square-Error plot analysis for improving SNR